tunnel dissolution front is explained by the geometrical requirement that the rate of accumulation of unreactive atoms on a receding singly curved surface (i.e. cylindrical tunnel walls) is greater than that on a receding doubly curved surface (i.e. hemispherical tunnel base). Consequently, the walls of a growing corrosion tunnel become protected by unreactive atoms before the base of the tunnel, thus establishing the basic condition for stable tunnel growth. The tunnel-type dissolution enables most of the base metal to be removed directly from the alloy surface. Contrary to the results of X-ray studies, no evidence was found for the bulk diffusion of the base metal to the surface over the distances claimed.

Tunnel corrosion has also been observed to nucleate at active slip steps and at grain boundaries, i.e. regions which are not protected by a gold surface layer. Furthermore, sponge-like corrosion structures which develop from these regions are found to fracture very easily in stressed specimens and ultimately to develop into recognisable stress corrosion cracks. Thus, the present work appears to have established a link between the stress corrosion of gold alloys containing base metals and their tendency toward micro-tunnel corrosion.

The Gold Content of Sea-water

ITS EXTRACTION AN UNREALISABLE DREAM

F. H. Lancaster

Chamber of Mines of South Africa, Johannesburg

The great increase recently in the price of gold has inevitably caused people to examine the possibility of recovering gold from deposits or sources which are not economic at the official price of gold.

One of these low-grade possible sources of gold is the sea, which has been described as a dilute solution of almost everything! Its volume, 1.37×10^{21} litres, is such that at the minute concentrations at which it occurs the total amount of gold in the sea could be of the order of 6 million tons, but the problem is, of course, the great volume of water that would have to be processed in order to extract gold in any worthwhile amount.

The existence of gold in the ocean has been known for a hundred years; the first officially recorded report of its gold content was made in 1872 by Edwards Sonstadt (1), who reported the gold concentration to be 65,000 micrograms per cubic metre.

Following Sonstadt, several investigators published the results of studies into the gold content of sea-water, while a number of patents were granted for processes for recovering gold from the sea. The most determined attempts were made by Fritz Haber, the German chemist and Nobel Prize winner, who after the First World War entered upon an extensive programme of research into the recovery of gold from sea-water with the object of paying Germany's war debts. Haber (2) found the concentration of gold to be much less than he had expected, seldom exceeding 0.001 mg per ton of sea-water. After ten years of work Haber came to the conclusion that gold could not be extracted economically from the sea. The average value of the gold concentration, Haber concluded, was about 0.04 mg/ton.

Since Haber's researches much time and effort have been spent on the development of methods for extracting gold from the sea. A process which it has been claimed could be used is an ion flotation process developed by Professor Felix Sebba (3) of the University of the Witwatersrand. A review by North (4) of the patents granted during a 75-year period showed that, except for the recovery of magnesium metal from sea-water, there has been no important commercially successful operation by which metal or metals are recovered from the sea as a sole or primary product. Recently J. B. Rosenbaum and his colleagues of the United States Bureau of Mines (5) concluded that not only is there at present no known procedure for the economic recovery of gold but that there is no process on the horizon which can be used for this purpose.

Rosenbaum and his colleagues, who used radiotracers to check on a solvent extraction-atomic absorption method, obtained a gold level of about 11 parts per 10^{12}, which agreed closely with the results of previous analyses in which ion exchange and neutron activation methods were used.

At the then ruling price of gold this content of gold would have represented a value of 0.001 cent (U.S.) per ton of sea-water, and as Rosenbaum concluded, even if regional differences in the gold content of the oceans were to reveal localities containing 50 times the 11 parts per 10^{12} level, the increased value of 0.05 cent (U.S.) per ton would still fall far short of that needed for economic exploitation.

The alchemists dreamed that gold could be obtained by the transmutation of lead. The more recent dream that gold might be obtained from the sea seems equally unrealisable in practice.

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